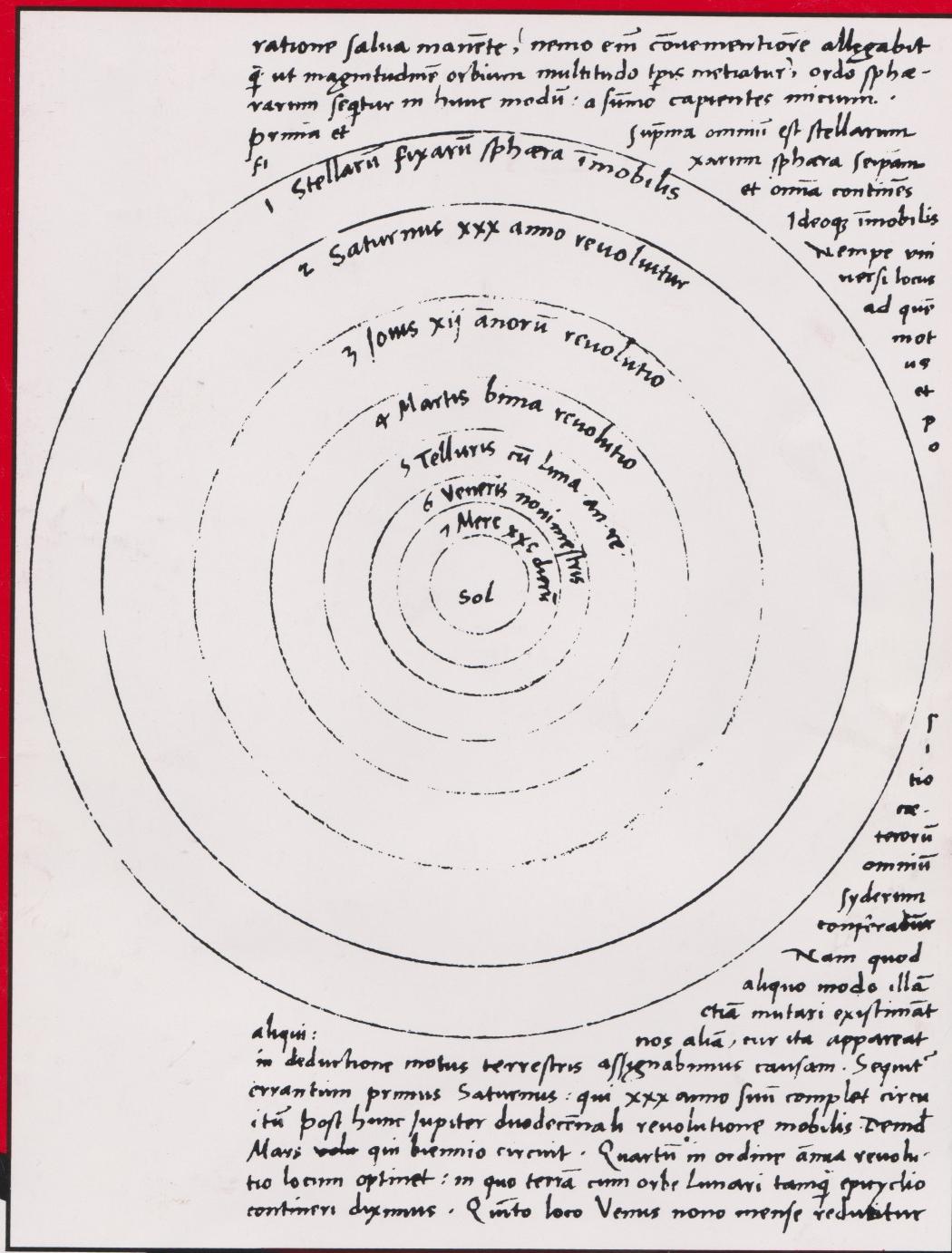


SCIENCE

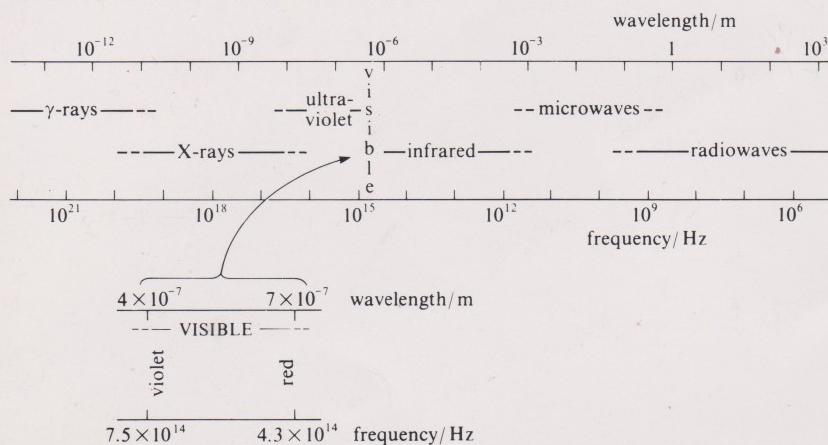


Unit 1
Science and the planet Earth

Unit 2
Measuring the Solar System

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

Symbol	Quantity	Approximate value
G	gravitational constant	$6.672 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
c	speed of light in a vacuum	$2.998 \times 10^8 \text{ m s}^{-1}$
h	Planck's constant	$6.626 \times 10^{-34} \text{ J s}$
e	magnitude of the charge of the electron	$1.602 \times 10^{-19} \text{ C}$
m_e	mass of the electron	$9.110 \times 10^{-31} \text{ kg}$
m_n	mass of the neutron	$1.675 \times 10^{-27} \text{ kg}$
m_p	mass of the proton	$1.673 \times 10^{-27} \text{ kg}$

USEFUL QUANTITIES AND CONVERSIONS

$\pi \approx 3.142$	Earth radius (equatorial) $\approx 6.38 \times 10^6 \text{ m}$
1 mile $\approx 1.609 \text{ km}$	circumference of the Earth (distance round the Equator) $\approx 4.01 \times 10^7 \text{ m}$
1 kilometre (km) $\approx 0.6214 \text{ mile}$	radius of the Moon $\approx 1.74 \times 10^6 \text{ m}$
1 inch = 2.54 cm	radius of the Sun $\approx 6.96 \times 10^8 \text{ m}$
1 centimetre (cm) $\approx 0.3937 \text{ inch}$	Earth-Sun distance (i.e. orbital radius of the Earth) $\approx 1.50 \times 10^{11} \text{ m}$
1 kilocalorie $\approx 4\,187 \text{ J}$	Earth-Moon distance (i.e. orbital radius of the Moon) $\approx 3.84 \times 10^8 \text{ m}$
1 electronvolt (eV) $\approx 1.602 \times 10^{-19} \text{ J}$	
1 radian $\approx 57.296 \text{ degrees}$	
1 degree $\approx 0.01745 \text{ radian}$	
1 $\text{GeV}/c^2 \approx 1.783 \times 10^{-27} \text{ kg}$	

S102 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
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7-8	Plate tectonics: a revolution in the Earth sciences	24	DNA: molecular aspects of genetics
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds	32	The search for fundamental particles

SCIENCE

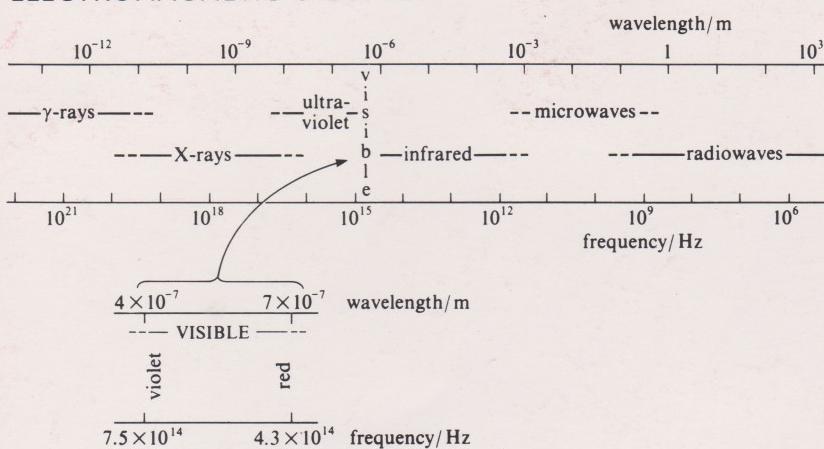


Unit 3
Motion under gravity

Unit 4
Practical work in science

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds	32	The search for fundamental particles

S102 UNITS 5-6

THE OPEN UNIVERSITY
S102: A SCIENCE FOUNDATION COURSE

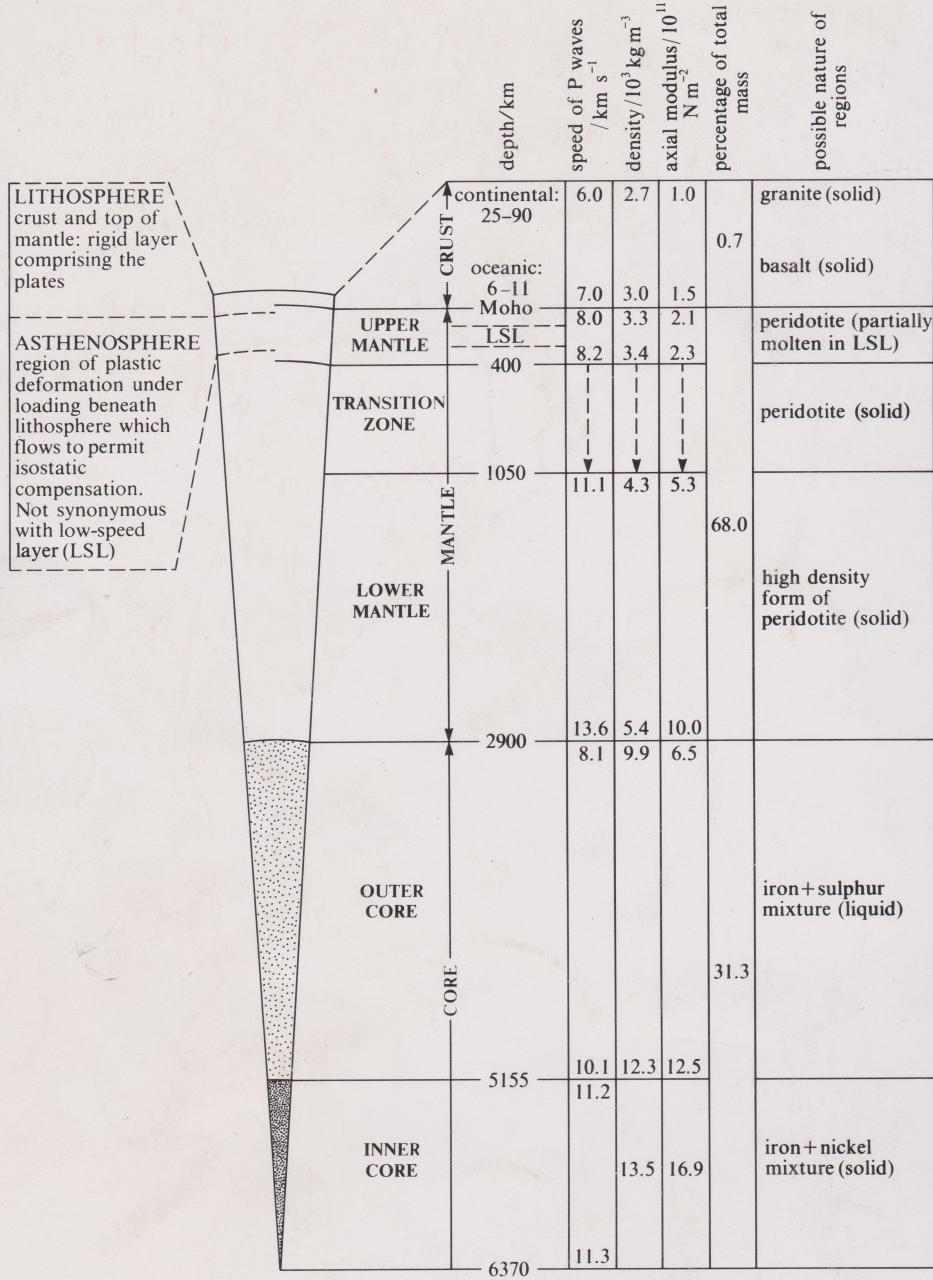
SCIENCE



Units 5-6

Into the Earth: earthquakes,
seismology and the Earth's magnetism

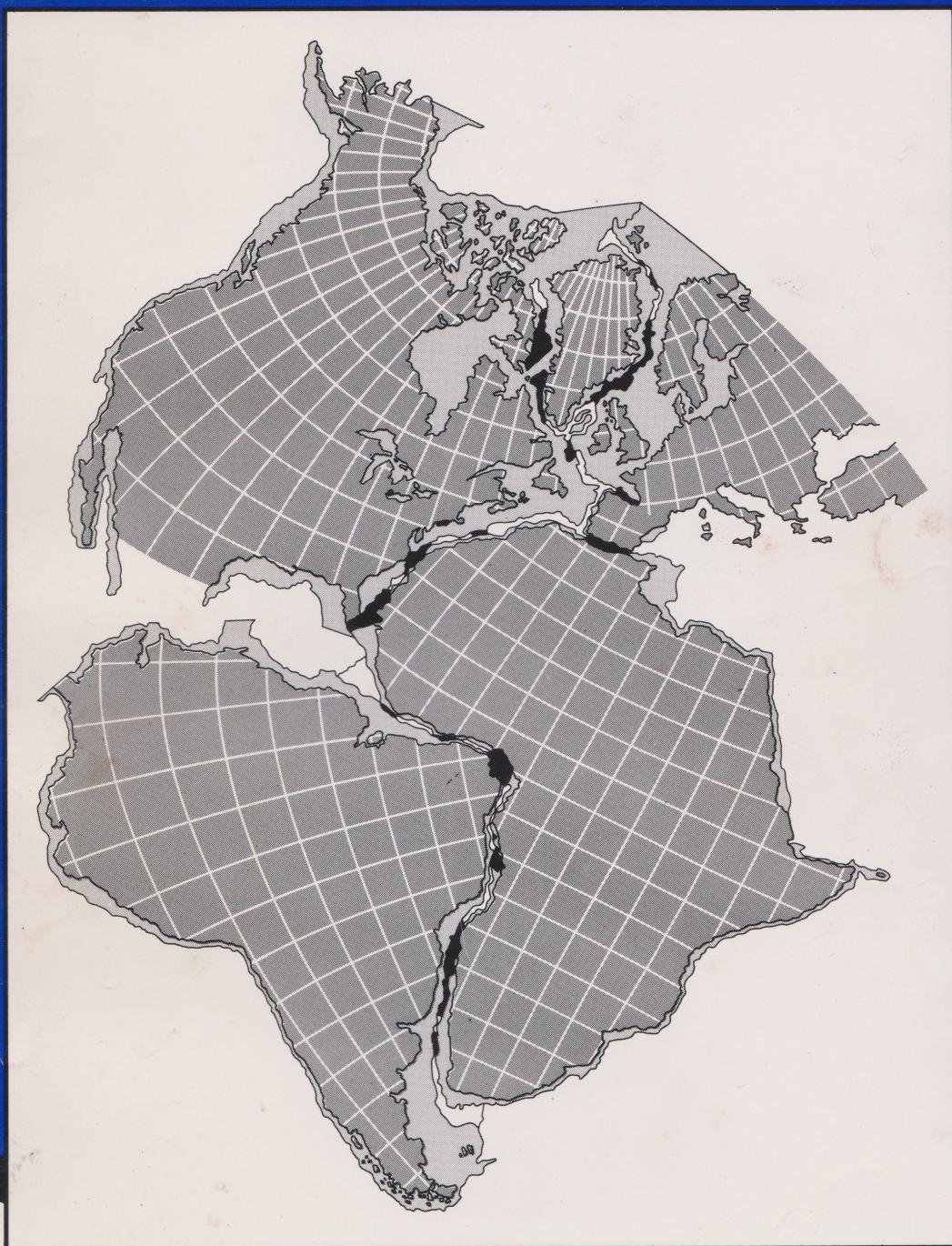
PROPERTIES OF THE EARTH'S INTERIOR



S102 UNITS

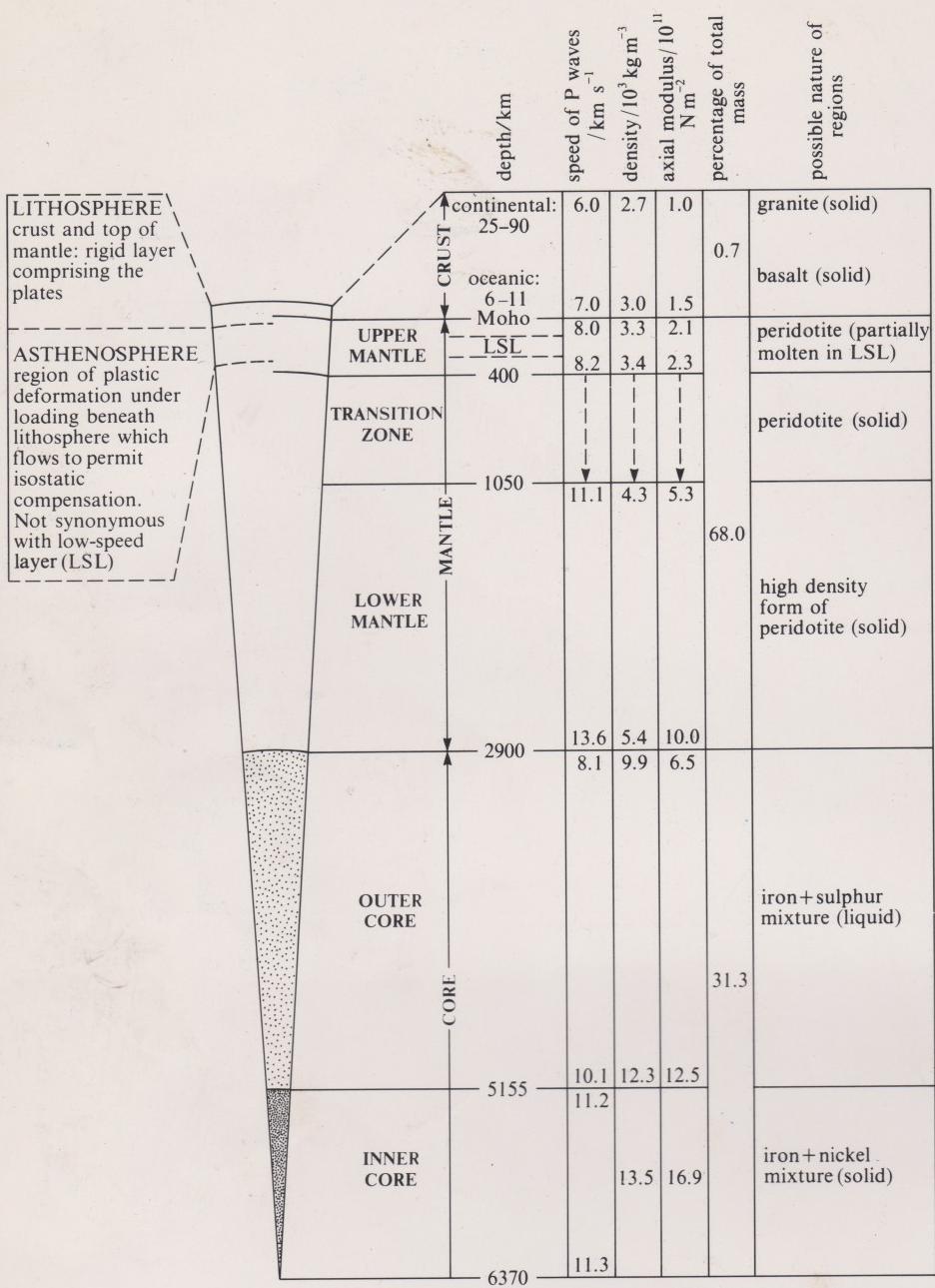
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2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds	32	The search for fundamental particles

SCIENCE



Units 7-8
Plate tectonics:
a revolution in the Earth sciences

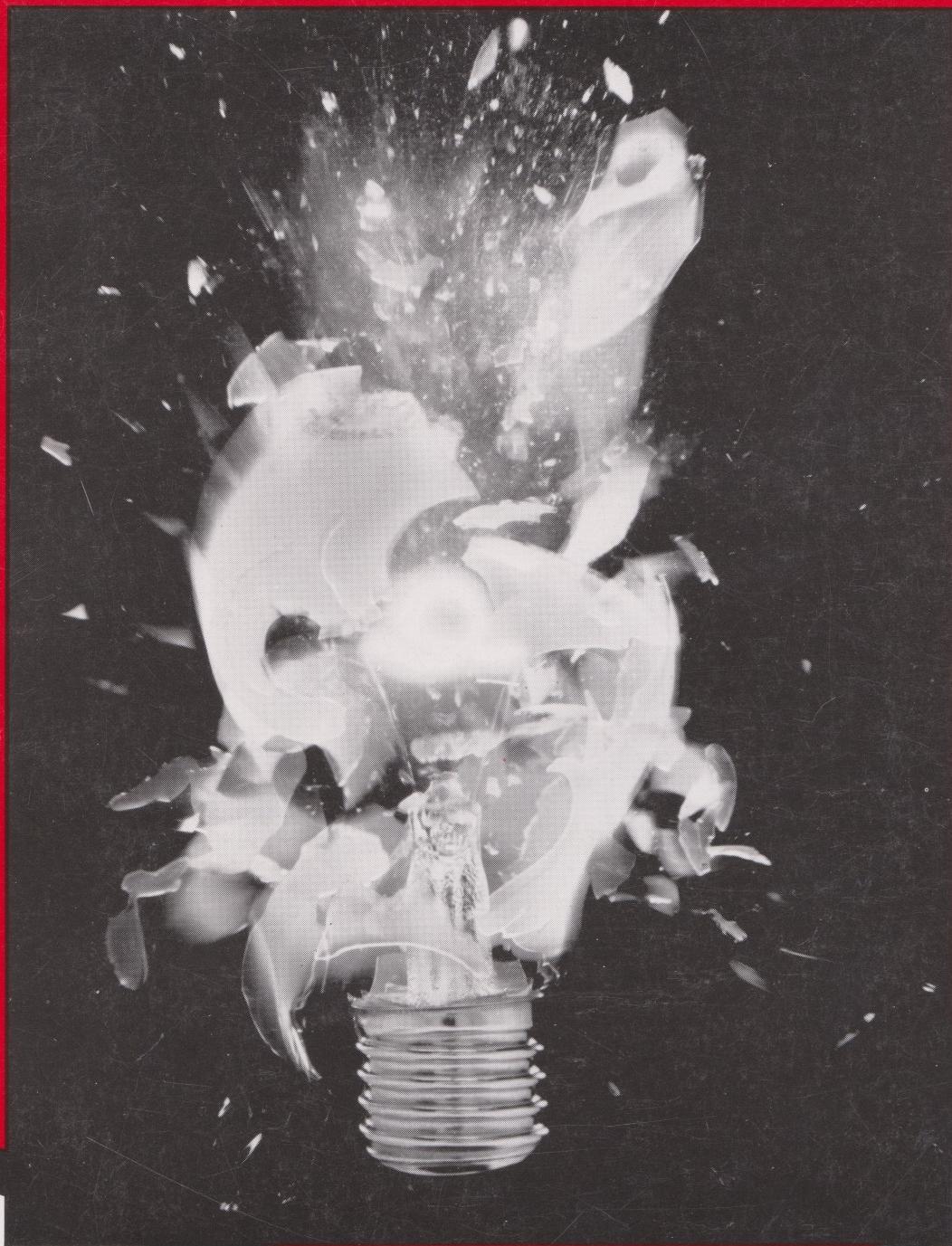
PROPERTIES OF THE EARTH'S INTERIOR



S102 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
5–6	Into the Earth: earthquakes, seismology and the Earth's magnetism	23	Physiology
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17–18	The chemistry of carbon compounds	32	The search for fundamental particles

SCIENCE

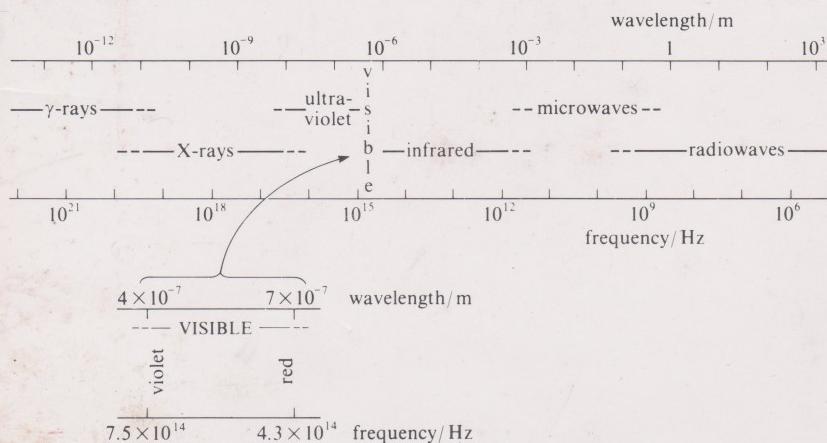


Unit 9
Energy

Unit 10
Modelling the behaviour of light

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

Symbol	Quantity	Approximate value
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c	speed of light in a vacuum	$2.998 \times 10^8 \text{ m s}^{-1}$
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1 $\text{GeV}/c^2 \approx 1.783 \times 10^{-27} \text{ kg}$	

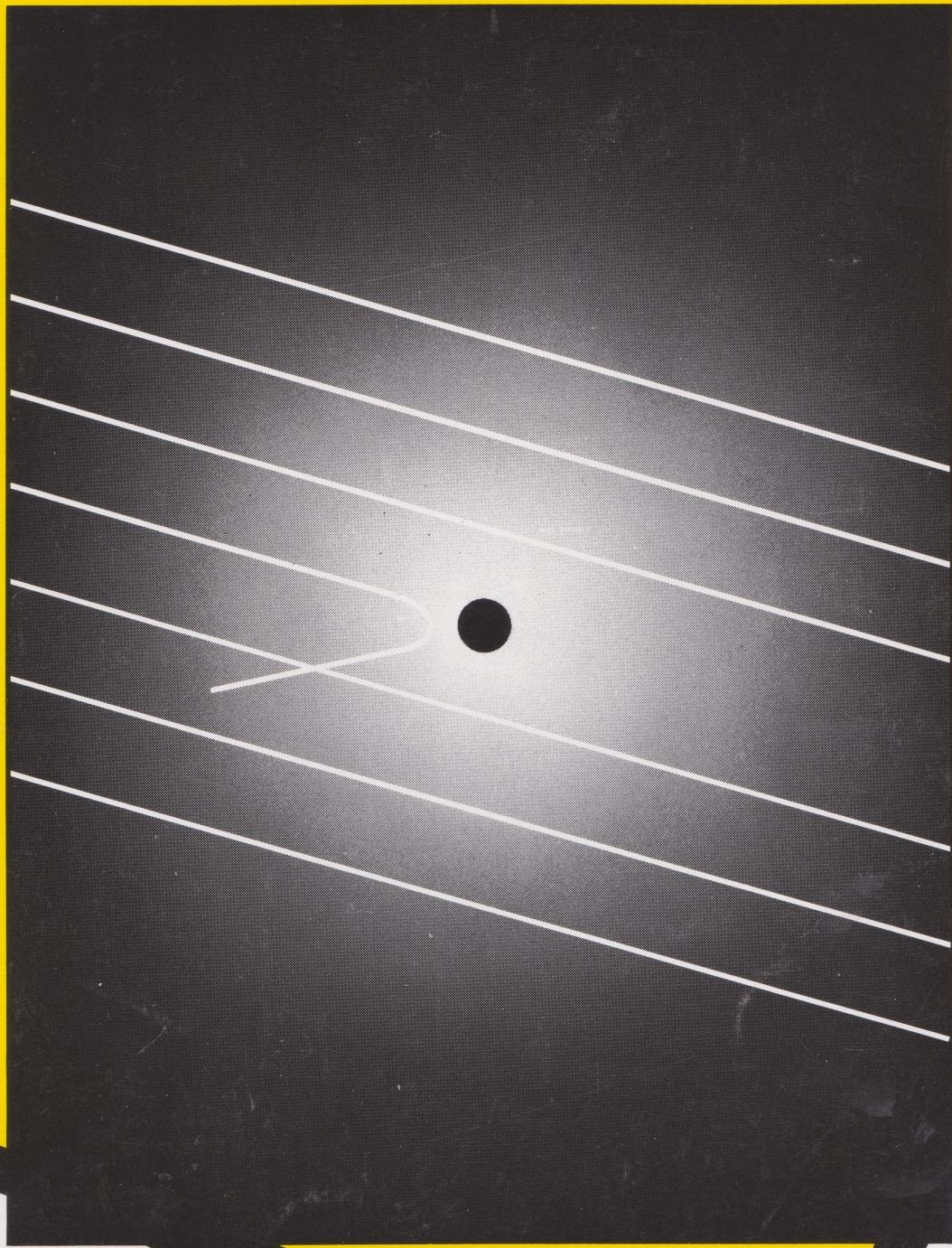
SI02 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
5-6	Into the Earth: earthquakes, seismology and the Earth's magnetism	23	Physiology
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds	32	The search for fundamental particles

S102 UNITS 11-12

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S102: A SCIENCE FOUNDATION COURSE 

SCIENCE



Units 11-12
Atomic structure

THE PERIODIC TABLE

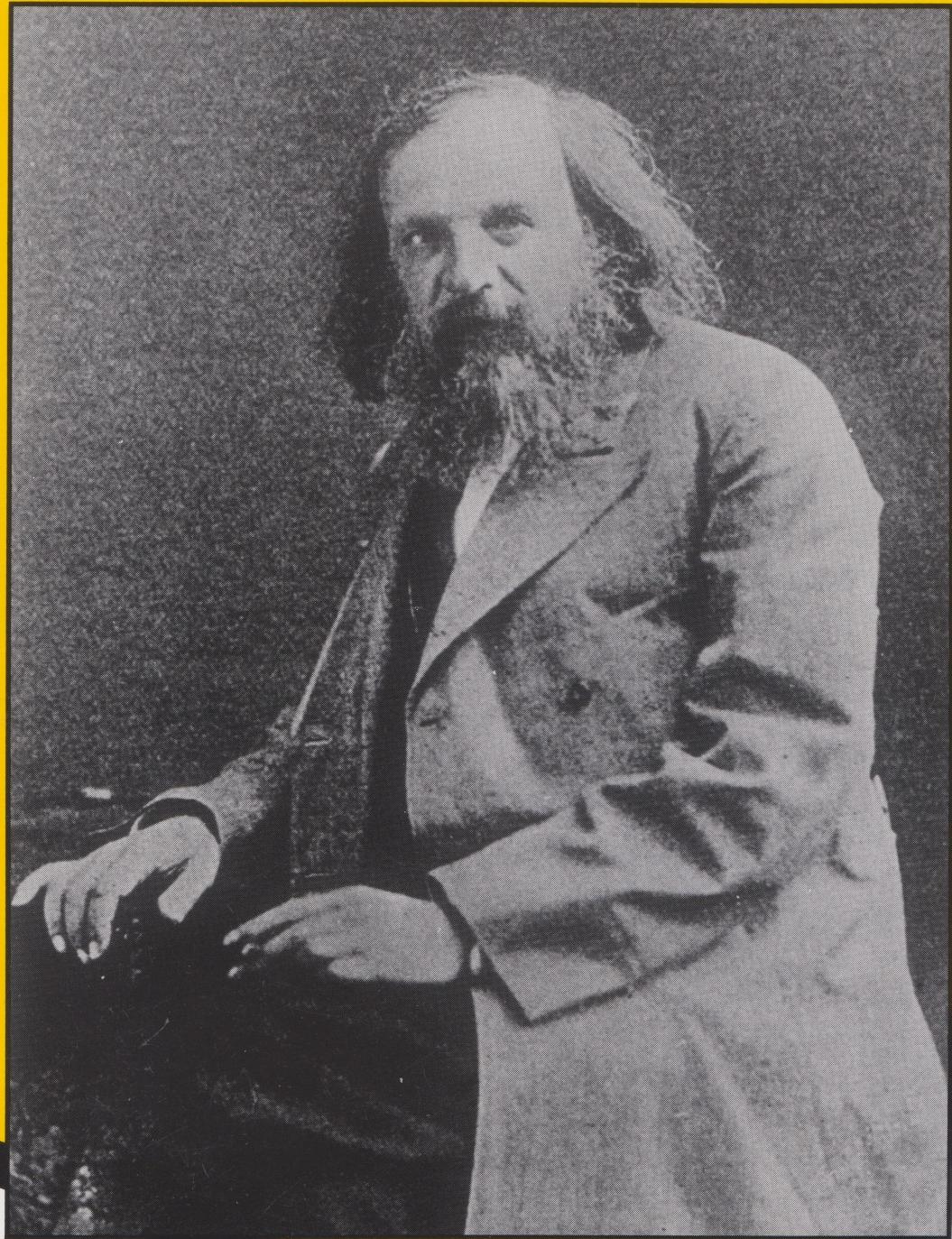
I	II				III	IV	V	VI	VII	0									
		1 H			2 He														
3 Li	4 Be			5 B	6 C	7 N	8 O	9 F	10 Ne										
11 Na	12 Mg			13 Al	14 Si	15 P	16 S	17 Cl	18 Ar										
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr		
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
55 Cs	56 Ba	57–70 lanthanides		71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89–102 actinides		103 Lr	104	105													
		transition elements																	
		typical elements																	
		lanthanides																	
		57 La																	
		58 Ce																	
		59 Pr																	
		60 Nd																	
		61 Pm																	
		62 Sm																	
		63 Eu																	
		64 Gd																	
		65 Tb																	
		66 Dy																	
		67 Ho																	
		68 Er																	
		69 Tm																	
		70 Yb																	
		89 Ac																	
		90 Th																	
		91 Pa																	
		92 U																	
		93 Np																	
		94 Pu																	
		95 Am																	
		96 Cm																	
		97 Bk																	
		98 Cf																	
		99 Es																	
		100 Fm																	
		101 Md																	
		102 No																	

S102 UNITS

- | | | | |
|-------|---|-------|--------------------------------------|
| 1 | Science and the planet Earth | 19 | Life and evolution |
| 2 | Measuring the Solar System | 20 | Inheritance and cell division |
| 3 | Motion under gravity | 21 | Genes and evolution |
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| 5–6 | Into the Earth: earthquakes, seismology and the Earth's magnetism | 23 | Physiology |
| 7–8 | Plate tectonics: a revolution in the Earth sciences | 24 | DNA: molecular aspects of genetics |
| 9 | Energy | 25 | Ecology |
| 10 | Modelling the behaviour of light | 26 | Biology reviewed |
| 11–12 | Atomic structure | 27 | Earth materials and processes |
| 13–14 | Chemical reactions and the Periodic Table | 28–29 | Geological time and Earth history |
| 15 | Chemical equilibrium | 30 | Quantum mechanics: an introduction |
| 16 | Chemical energetics | 31 | Quantum mechanics: atoms and nuclei |
| 17–18 | The chemistry of carbon compounds | 32 | The search for fundamental particles |

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SCIENCE



Units 13-14
Chemical reactions
and the Periodic Table

THE PERIODIC TABLE

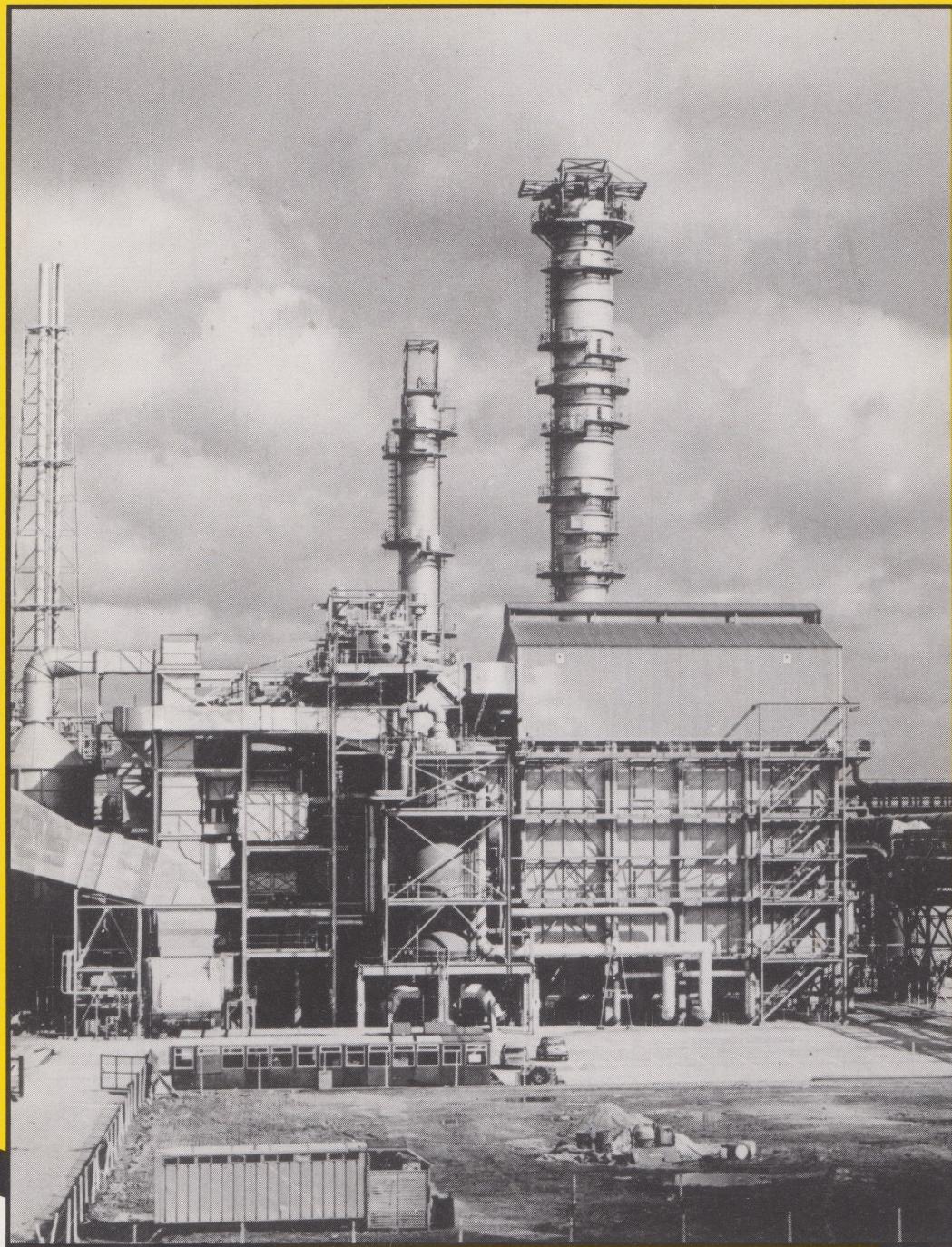
SIO2 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
5–6	Into the Earth: earthquakes, seismology and the Earth's magnetism	23	Physiology
		24	DNA: molecular aspects of genetics
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		26	Biology reviewed
9	Energy	27	Earth materials and processes
10	Modelling the behaviour of light	28–29	Geological time and Earth history
11–12	Atomic structure	30	Quantum mechanics: an introduction
13–14	Chemical reactions and the Periodic Table	31	Quantum mechanics: atoms and nuclei
15	Chemical equilibrium	32	The search for fundamental particles
16	Chemical energetics		
17–18	The chemistry of carbon compounds		

S102 UNITS 15 AND 16

THE OPEN UNIVERSITY 
S102: A SCIENCE FOUNDATION COURSE

SCIENCE



Unit 15
Chemical equilibrium

Unit 16
Chemical energetics

THE PERIODIC TABLE

I	II				III	IV	V	VI	VII	0									
		I	H							2 He									
3 Li	4 Be				5 B	6 C	7 N	8 O	9 F	10 Ne									
11 Na	12 Mg				13 Al	14 Si	15 P	16 S	17 Cl	18 Ar									
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr		
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
55 Cs	56 Ba	57–70 lanthanides		71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89–102 actinides		103 Lr	104	105													
		transition elements																	
		typical elements																	
		lanthanides																	
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb				
		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No				
		actinides																	

S102 UNITS

- | | | | |
|-------|---|-------|--------------------------------------|
| 1 | Science and the planet Earth | 19 | Life and evolution |
| 2 | Measuring the Solar System | 20 | Inheritance and cell division |
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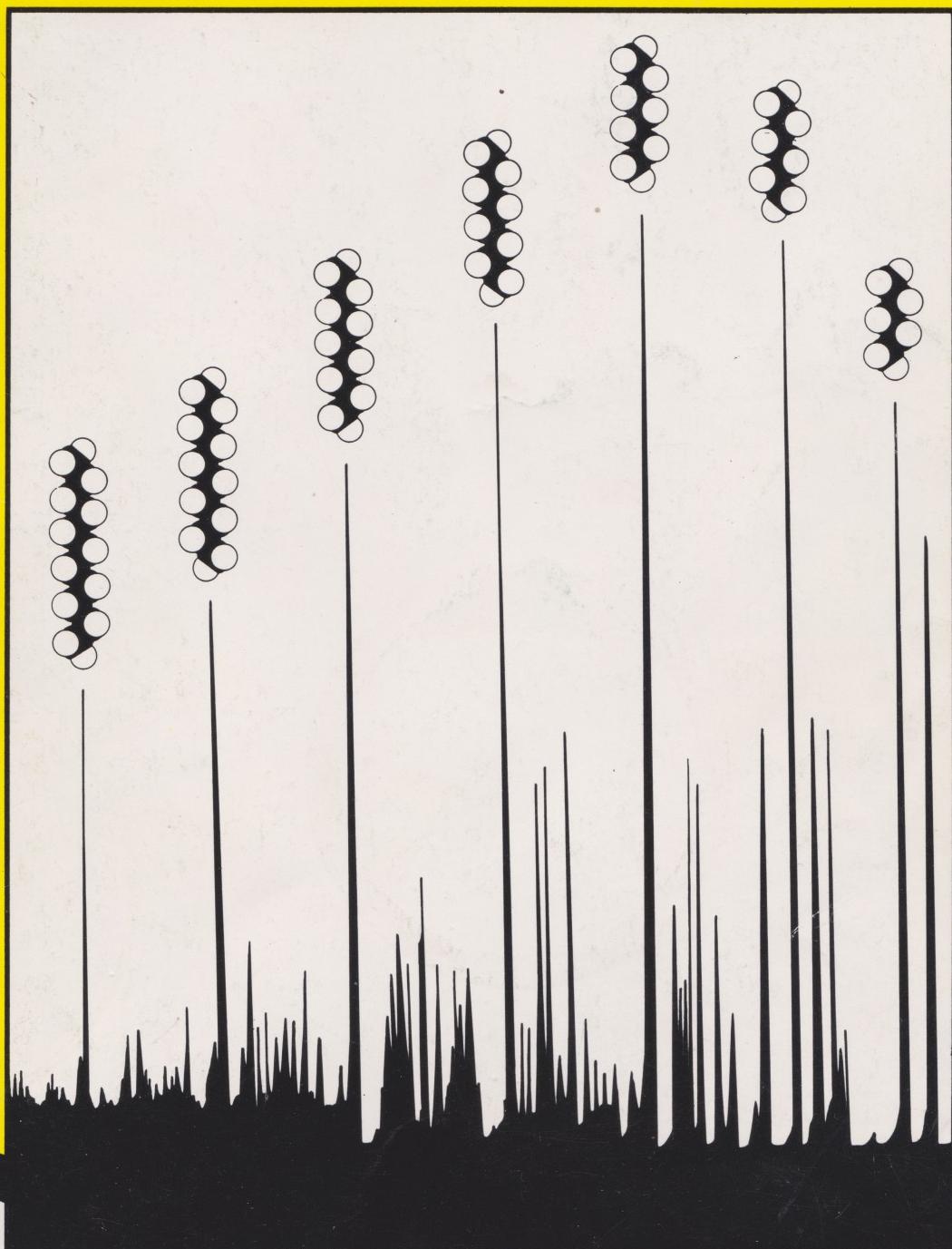
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S102 UNITS 17-18

THE OPEN UNIVERSITY
S102: A SCIENCE FOUNDATION COURSE

SCIENCE



Units 17-18
The chemistry of
carbon compounds

THE PERIODIC TABLE

I	II				III	IV	V	VI	VII	0										
		1 H							2 He											
3 Li	4 Be				5 B	6 C	7 N	8 O	9 F	10 Ne										
11 Na	12 Mg				13 Al	14 Si	15 P	16 S	17 Cl	18 Ar										
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr			
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe			
55 Cs	56 Ba	57–70 lanthanides		71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	
87 Fr	88 Ra	89–102 actinides		103 Lr	104	105														
transition elements											typical elements									
lanthanides											actinides									
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb							
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No							

S102 UNITS

- | | | | |
|-------|---|-------|--------------------------------------|
| 1 | Science and the planet Earth | 19 | Life and evolution |
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SCIENCE



Unit 19
Life and evolution

Unit 20
Inheritance and cell division

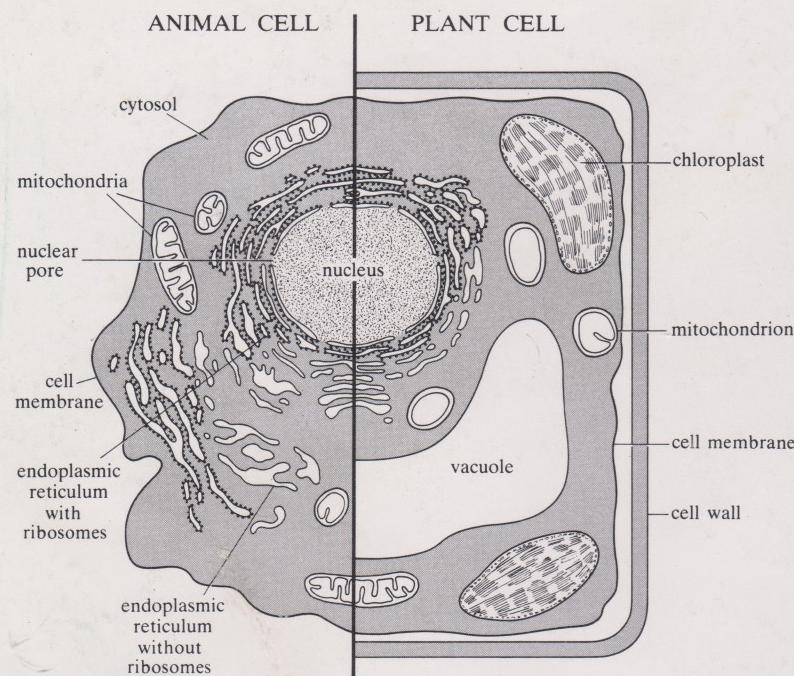
Unit 21
Genes and evolution

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

All cellular organisms contain these four biopolymers (made up of the monomers shown below).

Biopolymers:	polysaccharides	proteins	DNA	RNA
Monomers:	monosaccharides	amino acids	deoxyribonucleotides	ribonucleotides

All eukaryotic organisms have cells of the following generalized structure.



All living organisms can be divided into four kingdoms. The figures in brackets show the number of species (in thousands) in each subkingdom.

Animals	Plants	Fungi	Prokaryotes
sponges (4)	eukaryotic algae (20)	slime moulds (0.5)	bacteria (1.6)
unicells (40)	true plants (330)	true fungi (100)	blue-green bacteria (formerly termed blue-green algae) (1.5)
multicells (1 000–2 000)			

S102 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
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10	Modelling the behaviour of light	27	Biology reviewed
11–12	Atomic structure	28–29	Earth materials and processes
13–14	Chemical reactions and the Periodic Table	30	Geological time and Earth history
15	Chemical equilibrium	31	Quantum mechanics: an introduction
16	Chemical energetics	32	Quantum mechanics: atoms and nuclei
17–18	The chemistry of carbon compounds		The search for fundamental particles

SCIENCE



**Unit 22
Biochemistry**

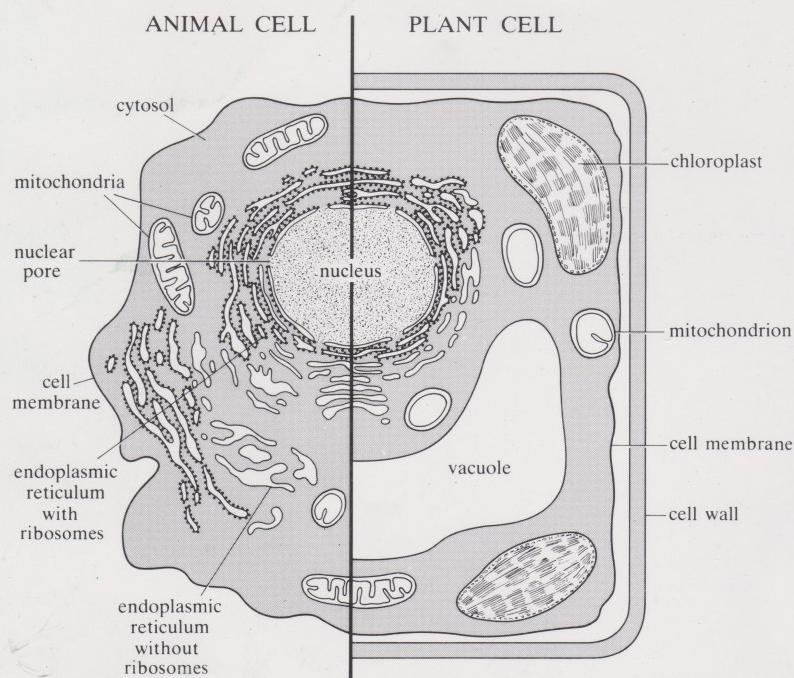
**Unit 23
Physiology**

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

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Monomers:	monosaccharides	amino acids	deoxyribonucleotides	ribonucleotides

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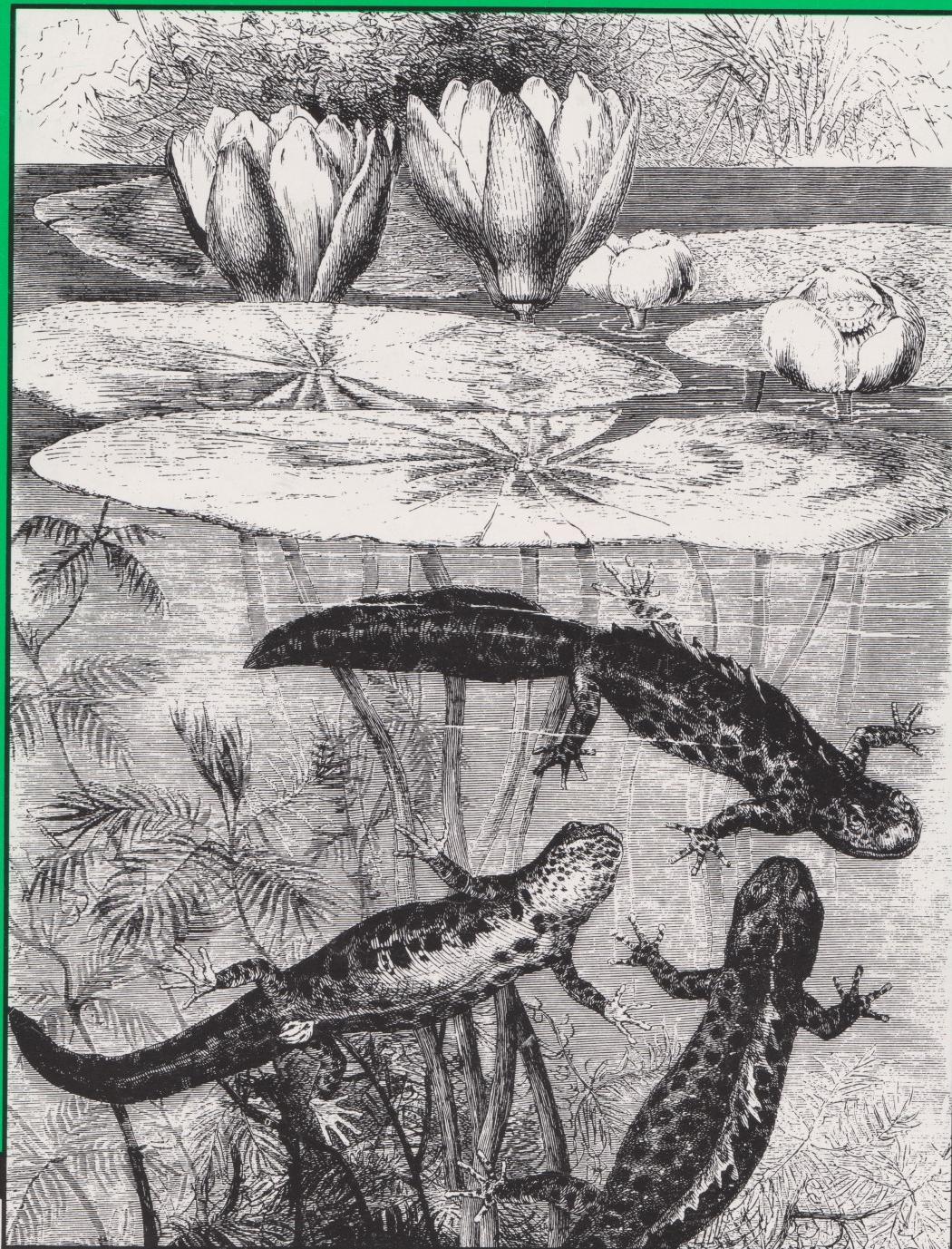
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multicells (1 000–2 000)			

S102 UNITS

1	Science and the planet Earth	19	Life and evolution
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
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SCIENCE



Unit 24
DNA: molecular aspects of genetics

Unit 25
Ecology

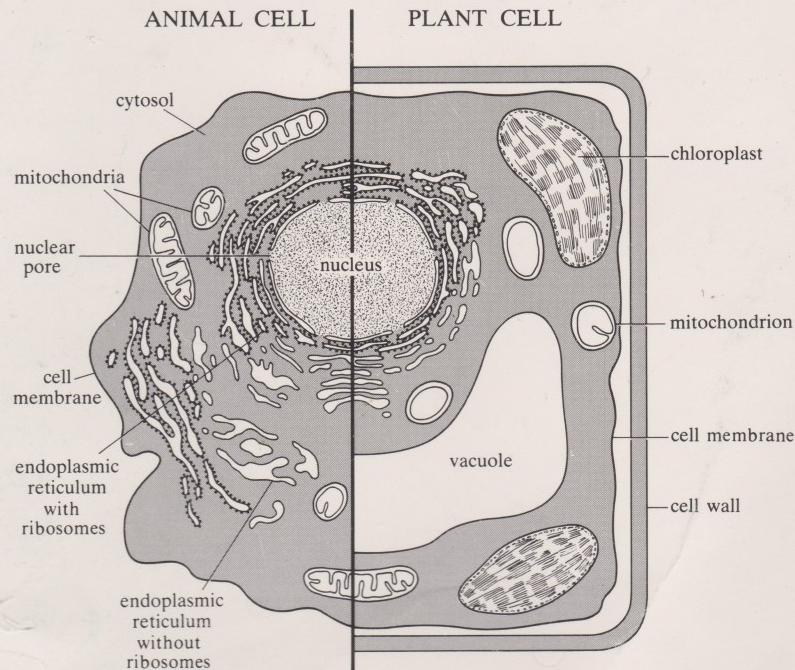
Unit 26
Biology reviewed

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

All cellular organisms contain these four biopolymers (made up of the monomers shown below).

Biopolymers:	polysaccharides	proteins	DNA	RNA
Monomers:	monosaccharides	amino acids	deoxyribonucleotides	ribonucleotides

All eukaryotic organisms have cells of the following generalized structure.



All living organisms can be divided into four kingdoms. The figures in brackets show the number of species (in thousands) in each subkingdom.

Animals	Plants	Fungi	Prokaryotes
sponges (4)	eukaryotic algae (20)	slime moulds (0.5)	bacteria (1.6)
unicells (40)	true plants (330)	true fungi (100)	blue-green bacteria (formerly termed blue-green algae) (1.5)
multicells (1 000–2 000)			

S102 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
5–6	Into the Earth: earthquakes, seismology and the Earth's magnetism	23	Physiology
7–8	Plate tectonics: a revolution in the Earth sciences	24	DNA: molecular aspects of genetics
9	Energy	25	Ecology
10	Modelling the behaviour of light	26	Biology reviewed
11–12	Atomic structure	27	Earth materials and processes
13–14	Chemical reactions and the Periodic Table	28–29	Geological time and Earth history
15	Chemical equilibrium	30	Quantum mechanics: an introduction
16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17–18	The chemistry of carbon compounds	32	The search for fundamental particles

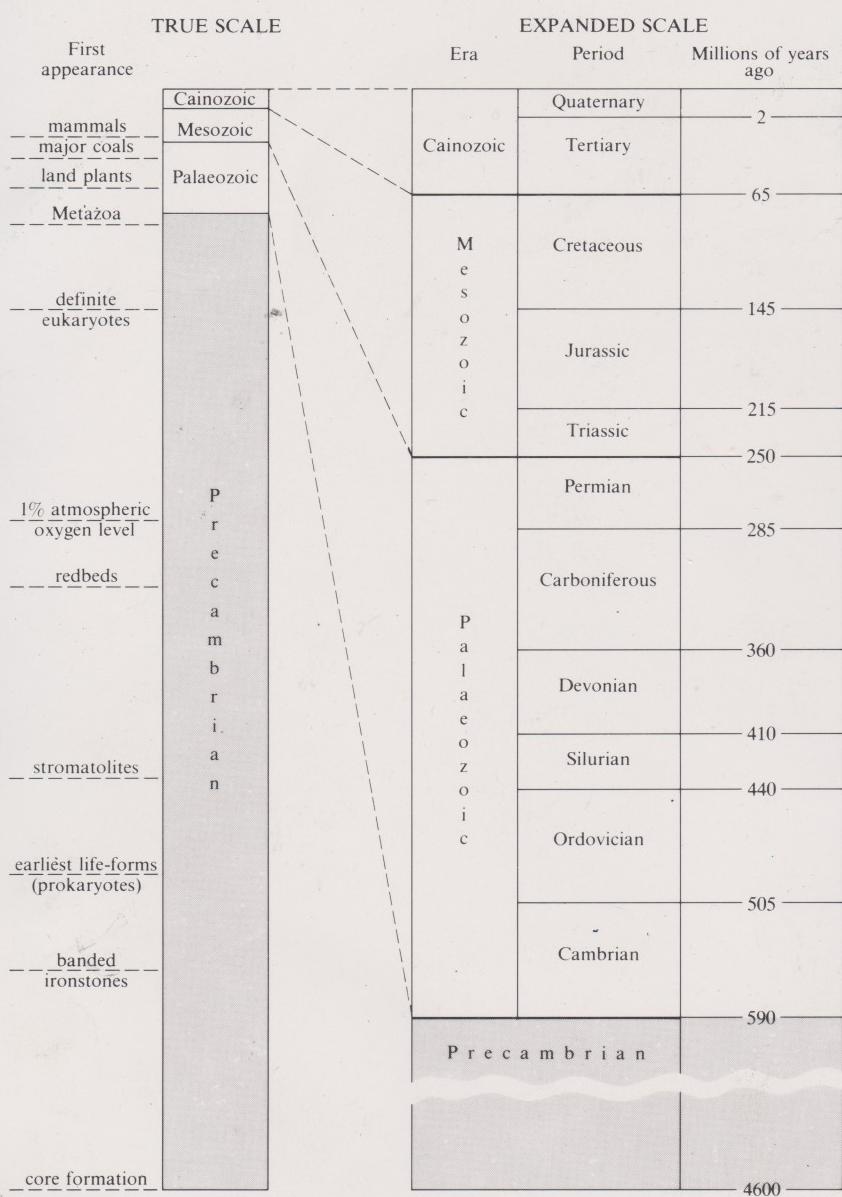
SCIENCE



Unit 27
Earth materials and processes

Units 28–29
Geological time and Earth history

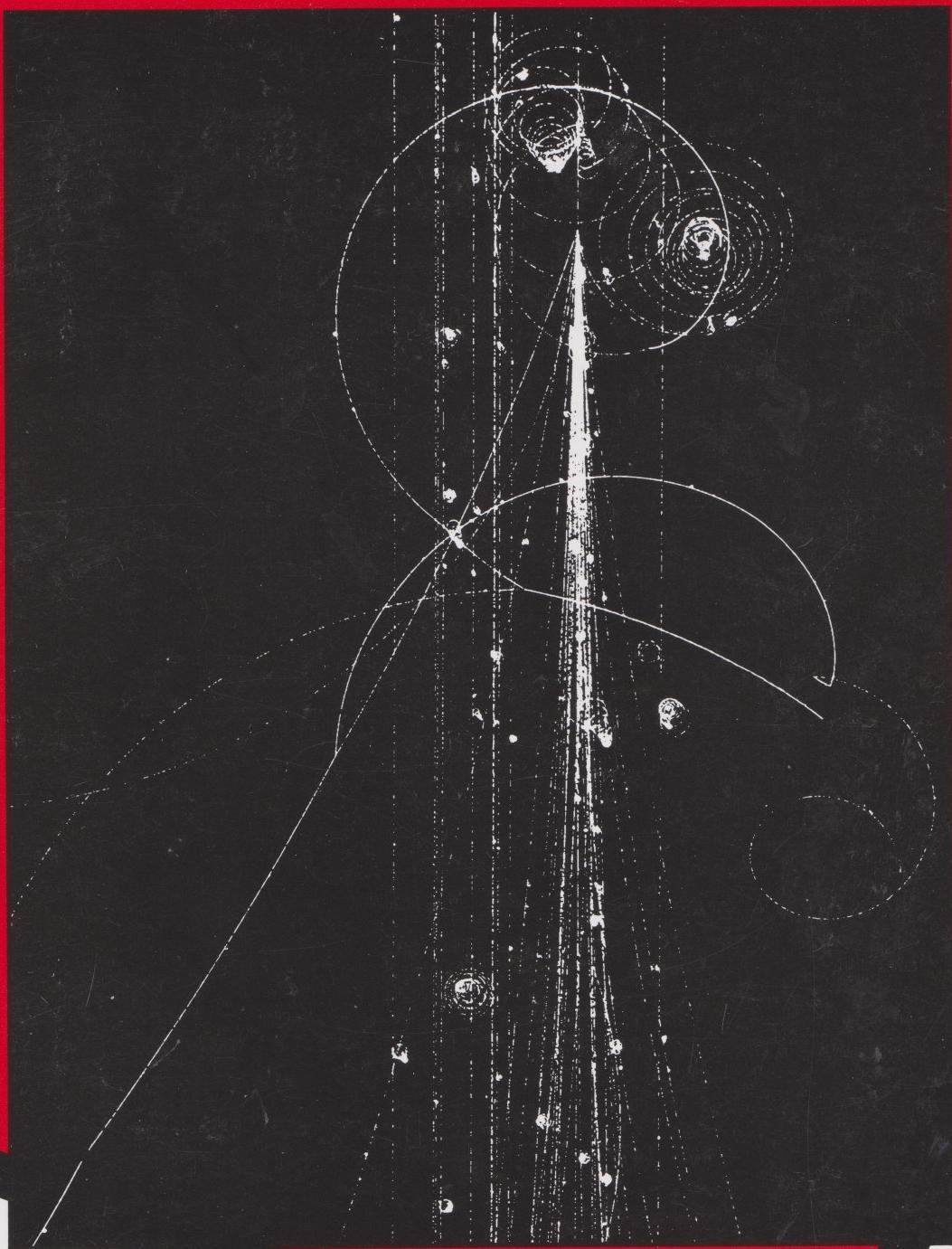
EARTH HISTORY AND STRATIGRAPHIC COLUMN



S102 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
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16	Chemical energetics	32	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds		The search for fundamental particles

SCIENCE



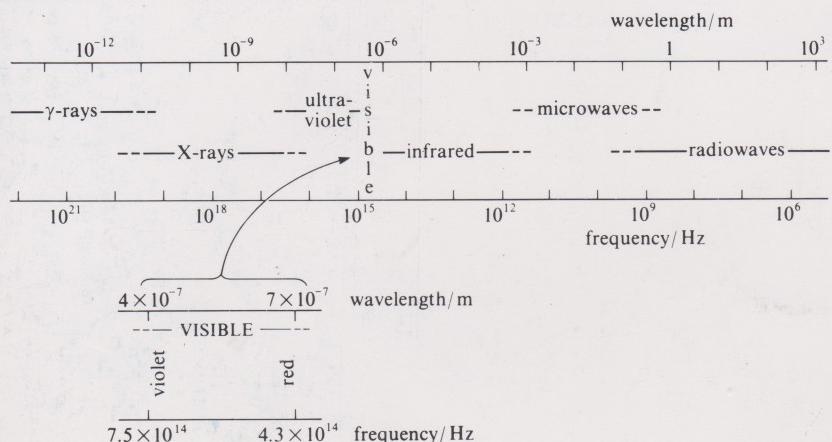
Unit 30
Quantum mechanics:
an introduction

Unit 31
Quantum mechanics:
atoms and nuclei

Unit 32
The search for fundamental particles

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

Symbol Quantity

G	gravitational constant	$6.672 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
c	speed of light in a vacuum	$2.998 \times 10^8 \text{ m s}^{-1}$
h	Planck's constant	$6.626 \times 10^{-34} \text{ J s}$
e	magnitude of the charge of the electron	$1.602 \times 10^{-19} \text{ C}$
m_e	mass of the electron	$9.110 \times 10^{-31} \text{ kg}$
m_n	mass of the neutron	$1.675 \times 10^{-27} \text{ kg}$
m_p	mass of the proton	$1.673 \times 10^{-27} \text{ kg}$

USEFUL QUANTITIES AND CONVERSIONS

$$\pi \approx 3.142$$

$$1 \text{ mile} \approx 1.609 \text{ km}$$

$$1 \text{ kilometre (km)} \approx 0.6214 \text{ mile}$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ centimetre (cm)} \approx 0.3937 \text{ inch}$$

$$1 \text{ kilocalorie} \approx 4187 \text{ J}$$

$$1 \text{ electronvolt (eV)} \approx 1.602 \times 10^{-19} \text{ J}$$

$$1 \text{ radian} \approx 57.296 \text{ degrees}$$

$$1 \text{ degree} \approx 0.01745 \text{ radian}$$

$$1 \text{ GeV}/c^2 \approx 1.783 \times 10^{-27} \text{ kg}$$

$$\text{Earth radius (equatorial)} \approx 6.38 \times 10^6 \text{ m}$$

$$\text{circumference of the Earth (distance round the Equator)} \approx 4.01 \times 10^7 \text{ m}$$

$$\text{radius of the Moon} \approx 1.74 \times 10^6 \text{ m}$$

$$\text{radius of the Sun} \approx 6.96 \times 10^8 \text{ m}$$

$$\text{Earth-Sun distance (i.e. orbital radius of the Earth)} \approx 1.50 \times 10^{11} \text{ m}$$

$$\text{Earth-Moon distance (i.e. orbital radius of the Moon)} \approx 3.84 \times 10^8 \text{ m}$$

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